

Prioritizing scenarios for the MSE

A discussion document in preparation for Hake MSE Working Group call #3
June 26, 2018 10-11a

Goal for the call: Identify and prioritize the most important areas of **current** and **future** uncertainty to the MSEWG

One of the goals of management strategy evaluation is to test the robustness of the performance of management strategies (the parts of the management process we *can* control) to a range of plausible alternative realities (the parts of the system we *cannot* control). In other words, we might want the harvest control rule and assessment model to allow us to meet our management goals, even if X happens, or Y changes, or we are totally wrong about Z. Here, we aim to identify *reasonable* types of uncertainty (the X, Y, Z) that the MSEWG would want a management strategy to be robust to, or is most concerned about.

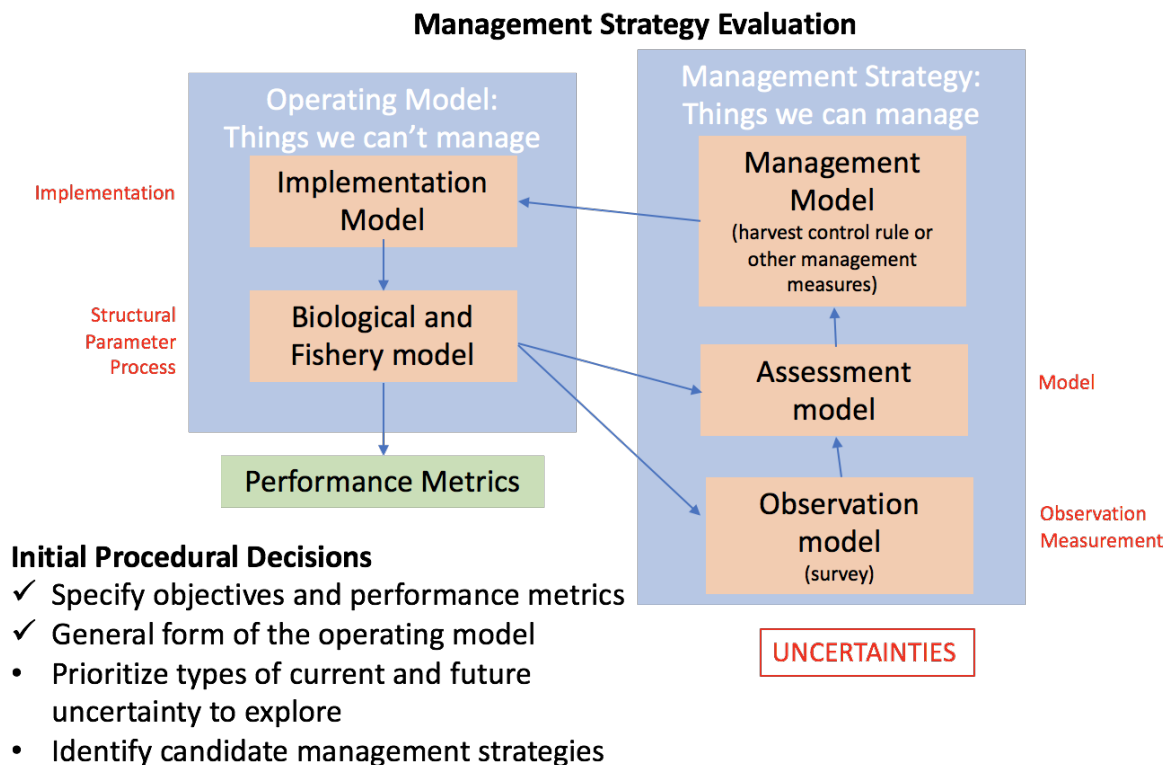


Fig 1. Schematic of a Management Strategy Evaluation approach.

There are multiple types of uncertainties we can potentially consider. Multiple operating models are used to explore one type of uncertainty, structural uncertainty, which reflects different assumptions about the functional form of relationships in the model. For example, the shape of the relationship between recruitment and stock size may take on different forms, as could the relationship between movement rate and fish age. Other types of uncertainty include parameter uncertainty (e.g., the value assumed for the natural mortality rate), process uncertainty (e.g., recruitment this year is related to recruitment last year), observation uncertainty (e.g., the survey

estimate is biased), and implementation uncertainty (catch is less or more than the TAC). We can define uncertainty as affecting the *historical period* (what happened in the past), the *projection period* (what will happen in the future), or both.

The three previously stated goals of the MSE highlight several uncertainties:

- Evaluate the performance of current hake management procedures under **alternative hypotheses about current and future environmental conditions** (*links to FATE Hake project*)
- Better understand the effects of **hake distribution and movement** on both countries' ability to catch fish
- Better understand how fishing in each country affects the availability of fish to the other country in future years

From these, we can begin to formulate plausible hypotheses about the present and future.

Potential hypotheses for current hake **movement**:

- *Age-dependent*: The age-structure of the population determines how many fish are present in Canadian vs US waters. Larger fish have a greater probability of moving into Canada.
- **Environmental*: Environmental conditions determine how many fish are present in Canadian vs US waters. E.g., when waters are warmer, more fish move into Canada, regardless of age/size
- *Age-dependent and environmental*: Both the age-structure of the population AND environmental conditions determine how many fish are present in Canadian vs US waters. Larger/older fish have a greater probability of moving into Canada, and this probability is even higher when environmental conditions are favorable

Potential hypothesis about the effect of the future ***environment** on movement:

- Status quo: no change in future environment
- **Trend* (continuous increase or decrease) in movement rate with warming conditions
- **Movement* may exhibit regime-like patterns or follow an ENSO-like signal
- **Variability* in movement could increase in an unpredictable way

*Plausibility for current and future environmental effects will be informed by on-going FATE-funded work

If we chose these hypotheses, we would then test each candidate management strategy under each of the 3 ways to represent movement (operating models), and under each of the 4 future environmental hypotheses, for a total of 9 scenarios.

Discussion questions:

- Which sources of uncertainty do you think would have the greatest potential impact on the ability to achieve management goals?
- What other sources of uncertainty do you think we should consider?
- How would you characterize current and future environmental uncertainty?